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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/621,185

07/15/2003

Sang-Deok Kim

51876P361

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07/20/2004

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EXAMINER

KENNEDY, JENNIFER M

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 07/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/621,185

Applicant(s)

KIM, SANG-DEOK

Examiner

Jennifer M. Kennedy

Art Unit

2812



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 24 May 2004.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-4 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Response to Amendment***

In view of Applicant's arguments and the amendment to the claims, the rejections of claims under 35 U.S.C. 112 second paragraph, as being indefinite, are withdrawn.

In view of Applicant's amendments the specification the objection is withdrawn.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ooto et al. (U.S. Patent No. 6,215,187) in view of Cho (U.S. Patent No. 6,355,521).

Ooto et al. discloses the method of fabricating a capacitor for a semiconductor device, comprising the steps of forming a sacrificial layer (5e, 5d) in the height of the capacitor on the substrate wherein an etch rate of an upper portion of the sacrificial layer is lower than that of a lower portion of the sacrificial layer, wherein the sacrificial layer is a TEOS layer (see column 10, lines 28-50 and column 11, lines 25-33), forming a trench by selectively eliminating the sacrificial layer by a wet etch process (see column 11, lines 35-45), forming a bottom electrode (8) in the trench, forming a

dielectric thin film (1) on the bottom electrode, and forming the top electrode (9) on the dielectric thin film.

Ooto et al. does not disclose the method of eliminating the sacrificial layer. Cho et al. discloses the method of eliminating a sacrificial layer during the method of forming a capacitor (see column 3, lines 30-35, and Figures 1C and 1D). It would have been obvious to one of ordinary skill in the art at the time the invention was made to eliminate the sacrificial layer of Ooto et al. as Cho teaches in order to form a cylindrical structure to increase the effective surface area of the capacitor, and thus increase capacitance (see Cho, column 1, lines 45-50 and column 3, lines 30-35).

Claims 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ooto et al. (U.S. Patent No. 6,215,187) and Cho (U.S. Patent No. 6,355,521) in view of Mozumder et al. (U.S. Patent No. 5,546,312).

In re claim 3, Ooto et al. and Cho disclose the method as claimed and rejected above, but do not disclose the method wherein the sacrificial layer is formed in response to a RF power, an O<sub>2</sub> flow, and a spacing between the substrate and the shower head. Mozumder et al. disclose the method of forming a TEOS layer (the material of the sacrificial layer) is formed in response to a RF power, an O<sub>2</sub> flow, and a spacing between the substrate and the shower head (see column 4, lines 20-35). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the TEOS sacrificial layer of the combined Ooto et al. and Cho by the method of Mozumder et al. by controlling the RF power, the O<sub>2</sub> flow, and the spacing

between the substrate and the shower head in order to allow for optimal settings that allow for a uniform deposition rate of TEOS across the wafer and generally meet the tight set of specifications that integrated circuits require (see column 1, lines 25-35, column 2, lines 8-15, and column 4, lines 18-36).

Ooto et al. discloses the method wherein the lower portion of the sacrificial layer has a higher wet etching rate than a higher portion of the sacrificial layer does (see column 10, lines 44-50 and column 11, lines 35-45).

In re claim 4, Ooto et al. discloses the method wherein the sacrificial layer is deposited in a thickness ranging from about 10,000 angstroms to about 25,000 angstroms. The examiner notes that Ooto et al. teaches a sacrificial thickness that is about 8000 angstroms, which the examiner maintains is about 10,000 angstroms.

If for some reason it is believed by applicant that the sacrificial thickness is not disclosed by Ooto et al. the examiner maintains that it would have at least been obvious to form the sacrificial layer of a thickness ranging from about 10,000 angstroms to about 25,000. The selection of the sacrificial layer thickness is obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree

from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and *In re Aller*, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the sacrificial layer of a thickness of ranging from about 10,000 angstroms to about 25,000 since a thicker sacrificial layer would allow for a larger surface area of the bottom electrode to be formed upon, thus allowing for a capacitor with greater capacitance.

Note that the specification contains no disclosure of either the critical nature of the claimed thickness or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen thickness or upon another variable recited in a claim, the Applicant must show that the chosen sacrificial layer thickness is critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

### ***Response to Arguments***

Applicant's arguments filed 5/24/2004 have been fully considered but they are not persuasive. Applicant argues that Ooto discloses two interlayer oxide films 5d and 5e, and therefore does not disclose forming a sacrificial layer in the height of the capacitor on a substrate, wherein an etch rate of an upper portion of the sacrificial layer is lower than that of a lower portion of the sacrificial layer, wherein the sacrificial layer is a TEOS layer.

The examiner considered both 5d and 5e to together form the sacrificial layer. Both layers, which together form the sacrificial layer, are made of TEOS, albeit one portion of the sacrificial layer being a doped TEOS layer. The examiner notes that applicant also teaches that the invention could be made with two separate layers (see specification page 9, lines 3-7). Applicants also state that the invention could be performed with a single TEOS layer (see specification page 9, lines 8-9), which the examiner assumes is formed by gradually changing the process conditions during formation. The examiner notes that even in this situation, which the applicant defines as a single layer, could be considered many incremental layers, each with different etching characteristics, changing with the height of the capacitor.

Further, the examiner notes that Ooto discloses an alternative in which the sacrificial layer gradually changes in dopant concentration from the lower portion to the upper portion (see column 13, lines 10-45).

Finally, applicant argues that Mozumder does not disclose that the lower portion of the sacrificial layer has a higher wet etching rate than the upper portion of the sacrificial layer does. The examiner notes that Ooto et al. was relied upon to show this feature (see Non-Final Office Action, page 9, lines 4-6). In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

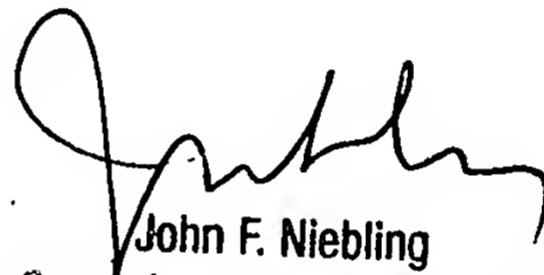
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Kennedy whose telephone number is (571) 272-1672. The examiner can normally be reached on Mon.-Fri. 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on (571) 272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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